

limitations on users.⁴⁷ Instead, the industry generally favors

radio equipment," at an estimated cost of \$5 million, a "figure [that] does not include the necessary in-street radio equipment."⁵¹

- The Office of the Sheriff of Maricopa County, Arizona, indicates that the county "is projecting costs exceeding 30 million dollars to replace existing radio equipment and construct new sites to provide coverage that we now require."⁵²
- The Idaho Department of Lands states that the Notice's height and power proposals "will devastate our existing statewide system" because the proposals will require "at least three or four times the present number of repeaters to cover the same area."⁵³ The Department indicates that the costs to the state of Idaho for the new sites, "if they were available," "would be prohibitive."⁵⁴
- The State of Alaska notes that "construction and operation of a site [in Alaska] is a considerable expense" because "many of [the state's] communications sites are on remote mountain peaks," and "most of these sites are accessible only by helicopter."⁵⁵ Given the cost of new sites, Alaska requested an exemption from any new height and power restrictions.
- The New York State Police indicate that the base transmitters they utilize for statewide operations will all need to be replaced, since the units are not type accepted for operation at the levels required by the Notice's proposals.⁵⁶

Ironically, most of these situations involve rural areas where spectrum congestion is not as severe in any event.

⁵¹ Suffolk County at 5.

⁵² Maricopa at 2.

⁵³ Idaho at 3.

⁵⁴ Id.

⁵⁵ Comments of the State of Alaska Division of Information Service Telecommunications Section at 3.

⁵⁶ New York at 8. See also San Jose at 2.

Under the circumstances, Motorola and the large majority of commenters object to the Notice's inflexible proposed height and power limitations. Instead, many commenters favor LMCC's approach that would guarantee licensees the ability to use specific powers and heights in a "safe harbor" table, and provide the flexibility to exceed the table values where necessary.⁵⁷ This approach preserves flexibility while encouraging use of lower power facilities.

IV. THE COMMISSION SHOULD ADOPT THE TIA RECOMMENDED EMISSION MASKS FOR 12.5 KHz EQUIPMENT

In its comments, the TIA submitted recommended emissions masks for 12.5 kHz and 6.25 kHz equipment. TIA noted that the FCC's proposal which would render all existing or compatible 12.5 kHz equipment non-compliant, including systems newly designed to be compatible with APCO's Project 25 and 12.5 kHz systems that has been designed for operation in other countries.

As stated in its original comments, Motorola supports the use of the TIA masks. The modifications that would be necessary to conform existing 12.5 kHz equipment to the FCC proposed emissions mask would result in millions of dollars of redesign and delay the immediate use of 12.5 kHz products. Most importantly, however, the TIA masks will provide more than adequate adjacent channel protection and efficient spectrum utilization.

⁵⁷ See, e.g., Comments of Cascade Telephone Communications at 7.

V. OTHER ISSUES

A. There Is Near Unanimity Against the Notice's Proposed "Innovator Blocks"

Commenters have nearly unanimously opposed the proposal in the Notice to create "innovator blocks" for two reasons.⁵⁸ First, the innovator block proposal fragments the private land mobile radio spectrum. Under the proposal, contiguous blocks of spectrum will not be assigned to the same user category, increasing frequency coordination difficulties and making it extremely difficult to aggregate channels to achieve wider bandwidths for data applications.

Second, the proposal would result in private users funding the transition to narrower equipment in order to "create

B. The Commission Should Explore the Need for Additional Low Power Itinerant Channels

The comments also indicate that the FCC should explore the need for further low power itinerant channels. Currently, there are only 3 itinerant channels -- one at VHF and 2 at UHF -- which are heavily used. Until now, however, licensees have been able to utilize the 2 watt offset channels at UHF as regional itinerants. With the potential conversion of a portion of the 2 watt offset channels at UHF to site specific operations, the need for additional itinerants will increase.

Motorola believes that additional itinerant channels should be created. The flexible operational requirements and liberal licensing policies for the itinerants serve a variety of business communications needs as evidenced by the incredible loading that

Service (GMRS)⁶¹ for this purpose. If the itinerant use operations are confined to true 12.5 kHz operations, such use could have little or no effect on existing GMRS operations. Motorola therefore urges the Commission to explore further the need for low power itinerant channels that would serve both business and personal communications needs and on whether the GMRS offset channels offer any possibilities for such use.

C. Exclusive Channel Assignments

Also at issue in this proceeding is the concept of channel exclusivity for the private land mobile services operating below 512 MHz. Surprisingly, this issue was not high on the list of radio users' concerns as demonstrated by the comments. Clearly, however, some commenters fully support the policy but fail to provide a consistent mechanism for implementing exclusivity painlessly on both the Commission and other users.

In commenting on this issue, Motorola reminds the Commission of the benefits of channel sharing. As noted in our Reply Comments to the original Notice of Inquiry in PR Docket No 91-170, sharing has served the private land mobile industry well and has promoted the fullest utilization of any spectrum regulated by the Commission. In the major markets across this country, it is not uncommon for five, six, or seven hundred mobile units to share a single frequency. This represents loading that is three,

⁶¹ Section 95.1 et. seq. of the Commission's Rules.

four or even five times greater than the frequencies above 800 MHz where exclusivity is provided.

Motorola does not oppose channel exclusivity but questions how it will be implemented. Under even the most optimistic scenario, it is more than likely that the Commission will become embroiled in dispute resolutions where competing claims for the same channel must be resolved. With the Commission's limited staff, this will undoubtedly further delay the processing times for more routine applications. Motorola therefore urges the Commission to move cautiously in this area and remember that channel exclusivity is not a prerequisite to an efficient use of the spectrum.⁶²

VI. CONCLUSION

The comments in this proceeding clearly show that the Commission's refarming proposals require substantial modification in order to properly balance the need for improving spectrum efficiency and its attendant costs while continuing to provide users with a whole host of communications options which has been the hallmark of the private land mobile services. In Motorola's opinion, the best way to satisfy these intertwined objectives is to transition the VHF high band and the UHF bands to true 12.5

⁶² Motorola becomes particularly concerned when channel exclusivity is promoted to further the positions of for-profit private carriers at the expense of purely user owned and operated private land mobile systems. Simply stated, the Commission cannot reduce the channel access capabilities of private systems in order to promote the SMR or other for-profit carrier systems.

kHz channel plans over the next ten years. This is the only plan under consideration that can demonstrate today that it will: (1) improve spectrum efficiency, (2) minimize costs to users by providing forward and backward compatibility, and (3) satisfy a wide range of voice and data applications. The Commission simply cannot endanger the viability of communications systems that help protect the nation's citizenry and help fuel the nation's industries by mandating the use of unproven and developmental very narrowband technology.

APPENDIX A

ABSTRACT:

In its comments,¹ SEA, Inc. supports its recommendation for a 5 kHz channel plan for all of the refarmed bands treated in the proposed Part 88 Rules with several references to an article titled "Impact of digital techniques on future land mobile spectrum requirements."² We show that the Davidson & Marturano Article, taken in context, does not support 5 kHz channel spacing, and indeed implies that to provide advanced land mobile services such as facsimile, video and file transfer, greater channel spacings must be accommodated.

SEA ASSERTIONS ON 5 KHz TECHNOLOGY:

In its comments to the FCC in the Refarming proceeding, SEA, Inc. suggests that the Commission adopt a uniform 5 kHz channel spacing plan in all bands below 512 MHz considered in the Docket. In support, SEA cites the Davidson & Marturano Article, stating "[the authors] project that in the late 1990's, the [spectrum] efficiency [of new technology schemes] will exceed 3.5 b/s/Hz,"³ and,

Clearly, spectrum efficiency is improved if more communications channels can be placed within a given band of spectrum. In the past, the ability to decrease the channel size has been limited by both the transmission bandwidth and frequency stability concerns. As described previously, we expect the application of advanced semiconductor technology to reduce the transmission bandwidth.⁴

The SEA comments go on to state that "[b]ecause of [the advance of linear technologies] we believe that 5 kHz channels will be

¹ Comments of SEA Inc., PR Docket 92-235, (filed May 28, 1993).

² A. Davidson, L. Marturano, "Impact of digital techniques on future LM spectrum requirements," IEEE Vehicular Technology Society News, vol., 40, no. 2, May 1993 ["Davidson & Marturano Article"].

³ Davidson & Marturano Article at 17.

⁴ Id.

able to support a wide variety of applications including digital voice, intelligent vehicle highway systems, and facsimile."

EFFICIENCY OF 3.5 BITS/SEC/Hz BASED ON 25 KHz TECHNOLOGY:

While on the face, the cited passages from the Davidson & Marturano Article seem to support SEA, Inc.'s assertion above, in context the conclusions are somewhat different. The 3.5 bits/sec/Hz number cited by SEA is taken from a trend line presented in the article which is based on past and present 25 kHz technologies. This is significant in that past and state-of-the-art 5 kHz technologies show more modest efficiencies. For example, Motorola's current MIRS technology delivers 2.6 bits/sec/Hz in a 25 kHz channel. SEA's recommendation of 4.8 kbps in a 5 kHz channel represents an efficiency of less than 1 bit/sec/Hz. Various technology proposals exist for delivering data rates as high as 9.6 kbps in a 5 kHz channel (1.9 bits/sec/Hz), however unlike MIRS, these technologies have not yet matured enough to be brought to market. Accordingly, efficiencies on the order of 2 bits/sec/Hz are not yet viable for narrowband 5 kHz channels.

INTERFERENCE CONSIDERATIONS:

It is well known that one of the key considerations in implementing highly spectrally efficient linear technologies is

channel spacing are limited by adjacent channel interference considerations.⁶

The emphasis is added here to highlight the limitations of reduced channel spacing. Very narrow band technologies do provide more allocatable channels per kHz than wider band technologies, however, they must provide the same adjacent and alternate channel interference protection. To guarantee this protection, a greater portion of the refarmed spectrum must be allocated to guard band. For example, more spectrum must be spent on guard band for five contiguous 5 kHz channels than on one 25 kHz channel in the same spectrum. In order to achieve the same or better spectral efficiency, the 5 kHz channels must utilize a higher order modulation than the 25 kHz channel, at a resulting higher complexity and cost. This is the main reason why the spectral efficiencies of 25 kHz technologies have outpaced the spectral efficiencies of 6.25 kHz and 5 kHz technologies.

ADVANCED SERVICES REQUIRE GREATER AVAILABLE BIT RATES:

Another aspect of the Davidson & Marturano Article that the SEA comments ignore is the emphasis on greater user demand for bit rate than in the past. In the Davidson and Marturano Article, the authors describe several advanced land mobile radio services that they expect to become viable by 2000. The authors assert that as compression technology advances, and available bit rates rise, that services like facsimile, imaging, video and high speed data transfer should become viable. The clear implication is that the introduction of these services is directly dependent on the bit rate available to a user on future land mobile radio systems. Obviously, exclusively adopting very narrow bandwidth channels will delay the introduction of these advanced services through reduction in available bit rate per user.

CONCLUSION:

Based on the Davidson & Marturano Article, impending use of highly efficient linear technologies will increase land mobile radio spectral efficiencies to about 3.5 bits/sec/Hz by the late 1990's. This figure is based upon trends at 25 kHz channel spacing, however, and is not directly applicable to 5 kHz, where efficiencies are likely to be less. Moreover, restricting channel spacing to 5 kHz will serve to unduly limit the bit rate available to a given land mobile radio user, at the very time when higher bit rates per user are being demanded for advanced services like facsimile, imaging and video.

⁶ Id. (emphasis added).